PROPERTY OF THE
TTLE PUBLIC LIBRARY

Technology
Continuation
SEP 20 1943

BORDEN'S REVIEW of NUTRITION RESEARCH

Summaries and reviews of research information concerning the nutritive values of milk and milk products. Published by The Borden Company, 350 Madison Avenue, New York 17, N. Y.

SEPTEMBER, 1943 VOL. IV, No. 6

TRACE ELEMENTS IN NUTRITION – IODINE

More than two thousand years ago medicine men in ancient China cured human illnesses with secret remedies even stranger than the little-understood illnesses themselves. One of these strange medicinals was sponge taken from the sea, burned to a powder and fed to patients suffering from the disease now known as goiter. Hundreds of years later, similar remedies were found effective in Greece, where seaweeds as well as sponges were used to restore goitrous patients to normal. Many centuries passed before man learned that the miraculous curative power of seaweeds and sponges was due to the relatively high concentration of iodine in these materials. Indeed, the existence of the element iodine was not discovered until as late as the year 1811.

Even after recognition of the fact that the therapeutic effects of marine products were directly attributable to their iodine content, it remained for modern science to discover the exact significance of iodine in the living organism. Before this could be learned, it was necessary to know the story of the ductless glands and their secreted hormones and of the manner in which these powerful chemicals regulate the physiological balance of the animal organism.

When the role of iodine in nutrition became apparent, following the elucidation of its profound influence in thyroid function and body metabolism, attention was focused on the iodine supply of the diet. It was soon learned that the iodine content of foods and of water is extremely variable and that one of the chief determinants of their iodine content is geographical situation. Thus, in those areas where the iodine content of the soil and water is high, it is possible to grow foods relatively rich in iodine and to raise livsetock which produce milk and eggs reflecting the superior iodine content of the soil and of their feed. However, where the soil and drinking water are deficient in iodine, the local food supply is also deficient and unless remedial measures are taken (e.g. iodine fortification of foods or drinking water, the administration of iodine-rich fertilizers to the soil, or the use of sea foods or foods grown in areas where the soil is rich in iodine) endemic goiter usually makes its appearance. Statistical analysis of geographical surveys indicates that the incidence of goiter is inversely proportional to the iodine content of the soil and water and that the more severe the

iodine deficiency, the greater the incidence of simple goiter as well as other manifestations of thyroid dysfunction, such as cretinism and myxedema.*

Historical Background

Iodine was discovered accidentally in 1811 by Courtois (1), who found it as an impurity in certain seaweeds employed in the manufacture of potassium nitrate for gunpowder. Two years later the properties of the newly discovered element were announced by the chemist, Gay-Lussac, and shortly thereafter Sir Humphry Davy demonstrated its presence in sponges and other marine products. In but a few years following these two discoveries, the correlation was made between the empirical use of burnt sponge and seaweed as a cure for goiter and the iodine content of these materials. (This offered an interesting example of how empirical practice often may be correct, although no scientific explanation is available to explain the mechanism of action.) It followed logically, then, that iodine itself — in the form of tincture of iodine or iodine salts — be tested as a cure for the disease. It was soon found that administration of iodine compounds was indeed effective in causing the disappearance of many goiters. Since the mechanism of iodine therapy was not known at that time, and since there was no means of estimating proper dosage, toxic symptoms were frequently encountered as a result of excessive iodine administration, and consequently iodine therapy of goiter fell into disrepute for a time.

Toward the middle of the 19th century Chatin (2) demonstrated that iodine in minute quantities is universally present in nature, and that the amounts vary in different soils, waters, plants and animal products. He advanced the suggestion, on the basis of extensive data, that certain types of goiter are due to a relative deficiency of dietary iodine. However, other investigators at that time were unable to confirm Chatin's findings, so that his work and his theory were eventually discredited in scientific circles.

Not until more than thirty years later was scientific interest in iodine deficiency renewed. The beginning of this new era was marked by Baumann's (3) discovery, in 1895, of iodine in the thyroid gland. Baumann further demonstrated that in goiter, the iodine content of the thyroid was considerably less than that of the normal gland. His investigations as well as the early experiments of Chatin were taken up and repeated by others and at last confirmed. From that time onward the study of iodine in nutrition and of iodine prophylaxis in simple goiter proceeded at a rapid pace. From France, Switzerland, England, New Zealand and America, groups of scientists reported spectacular results in the treatment of animals and human beings, and as a result aroused the interest of other research workers and of public health officials in the significance of iodine in nutrition.

---

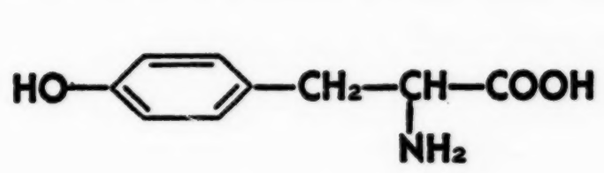
*There are many types of goiter and abnormalities resulting from thyroid dysfunction. In this Review only that type of goiter resulting from a nutritional deficiency of iodine (i.e. simple, endemic or nutritional goiter) will be discussed. Other manifestations of thyroid dysfunction are medical problems outside the realm of nutrition.

PROPERTY OF THE
SEATTLE PUBLIC LIBRARY

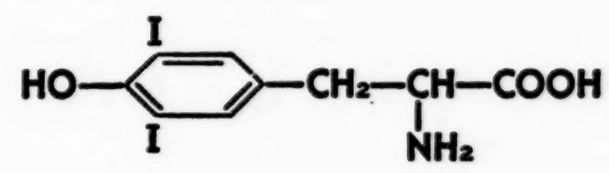
The Role of Iodine in Nutrition

Since Baumann's original discovery in 1895 that the thyroid gland contains most of the body store of iodine, considerable study has been made of the relation of iodine to the physiology of this gland. Twenty years later, on Christmas Day 1914 Kendall (4) succeeded in isolating in pure crystalline form the active principle of the thyroid. This material was found to contain about 65 percent of iodine and was named *thyroxin,* by Kendall. These discoveries marked two outstanding milestones in the history of iodine and the thyroid gland. The physiologic importance of iodine was now seen to be tied up with its occurrence in thyroxin, the secretion of the thyroid gland which exercises control over the rate of energy metabolism in the body.

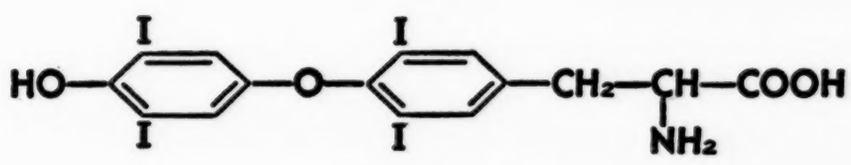
The Chemistry and Function of Thyroxin: Thyroxin is an iodine derivative of the amino acid tyrosine. It differs from di-iodotyrosine, also present in the thyroid, (apparently as an intermediate substance in the formation of thyroxin) in having an additional phenol group and two extra atoms of iodine. (It is interesting to note in this connection that di-iodotyrosine which is so similar to thyroxin, has considerably less influence than thyroxin, and indeed cannot substitute physiologically for the hormone.



tyrosine



di-iodo-tyrosine



thyroxin

Thyroxin exerts a profound influence on the rate of metabolism in the body. When administered to man in amounts as little as one or two milligrams, it is capable of effecting a marked increase in basal metabolism. Although the physiologic effect of thyroxin develops slowly following its injection, the heightened metabolism induced persists for many days after administration of the hormone has been discontinued. The thyroid hormone also exerts an important effect on growth, maturation, differentiation of tissue, water balance, carbohydrate metabolism. It is intimately involved in the functioning of the nervous, muscular, circulatory and reproductive systems, and with the activity of the other endocrine glands.

Disorders of the Thyroid Gland: Disorders of the thyroid gland are so intimately connected with thyroxin production and with iodine metabolism that a great deal concerning the physiological activity of iodine is disclosed through the study of such disorders. The diseased thyroid may produce either a defici-

ency or an excess of thyroid secretion. The deficiency state, described as *hypothyroidism* (subnormal thyroid activity) leads, in man, to three well-known pathological conditions, namely goiter, cretinism and myxedema.

Goiter is characterized by a swelling and enlargement of the thyroid under conditions of iodine deficiency in an effort to manufacture more of the deficient thyroxin. The administration of iodine stimulates production of the necessary hormone, so that the growth of the goiter is arrested and the incipient goitrous thyroid may even recede to normal size. Where it is known that the dietary iodine supply is likely to be deficient because of inadequacies of local soils, the increased use of iodine-rich foods or iodized salt will prevent the development of goiter.

Cretinism is the result of congenital degeneration of the thyroid in young children. It is characterized by marked retardation of growth, widespread abnormalities throughout the body, failure of the sex glands to develop, and arrested development of the central nervous system resulting in a condition of idiocy or feeblemindedness. The use of thyroid extract under medical supervision has been found helpful in effecting partial or complete cures, but is not always successful.

Myxedema occurs in adults suffering from a marked degree of thyroid insufficiency and is characterized by a greatly reduced metabolic rate, general wasting away, and mental deterioration.

The opposite state, described as *hyperthyroidism* (excessive thyroid activity), results in the condition known as exophthalmic goiter, toxic goiter or Graves' disease. This type of goiter, as well as various other types beyond the scope of this Review, is not caused by a lack of iodine. Exophthalmic goiter is characterized by a heightened metabolism, nervousness, protruding eyes, etc.

The Metabolism of Iodine: Iodine is absorbed from the intestinal tract and circulates, usually in the form of iodides, in the blood. Thyroid tissue exhibits a marked affinity for iodine, absorbing the great majority of this material from the blood stream. Studies with the radioactive isotope indicate that this absorption occurs within a remarkably short period after ingestion (5). The thyroid acts as the principal storehouse for iodine, storing the material in the form of thyroxin and di-iodotyrosine. No other organ of the body has the power of iodine concentration possessed by the thyroid. The iodine concentration in the blood, for example, is somewhat less than one part in 25 million, whereas in the thyroid gland the iodine concentration is approximately one part in 25 hundred (21). In addition to its occurrence in the thyroid gland and in the blood stream, iodine is distributed throughout the body, in varying minute amounts, in the muscles, skeleton, skin, and endocrine glands.

Excess iodine not fixed by the thyroid gland is quickly carried around the body and eventually eliminated (6). Most of the excreted iodine is eliminated by way of the urine, although small amounts are lost also through the intestinal tract, in perspiration and in milk.

Manifestations of Iodine Deficiency

Endemic goiter is probably the most widely recognized manifestation of iodine deficiency. Although the fundamental cause of endemic goiter is not clear, it is apparent that the immediate cause is a deficiency of iodine necessary in the formation of thyroxin. Iodine deficiency may be either absolute, due to dietary deficiency, or it may be relative, dependent upon certain bodily conditions necessitating an increased secretion of the thyroid hormone. Such conditions include puberty, pregnancy, lactation, and the like.

It was demonstrated, by Marine and Lenhart (7) more than forty years ago, that when the iodine concentration of the thyroid gland falls below 10 milligrams per hundred grams (average normal concentration — 40 milligrams per 100 grams), an increased growth of glandular tissue ensues resulting in goiter. This phenomenon is thought to be a compensatory mechanism on the part of the thyroid to make up for the deficiency in thyroid secretion.

The first modern experiments in the treatment of simple goiter with iodine were those of Marine and co-workers on trout reared under artificial conditions for commercial purposes (8). The mortality from goiter among the fish was so high that the industry was threatened with extinction. In accordance with their observation that a subnormal level of iodine in the thyroid gland invariably precedes the development of goiter, Marine and Lenhart attempted to solve the problem by adding small quantities of iodine to the water supply. To their great satisfaction, the treatment proved completely effective and they were able to eliminate goiter among the trout. They soon found that replacing the previous diet with whole sea fish rich in iodine was equally efficacious.

About ten years after the remarkable success in the prevention of goiter among brook trout, Marine and Kimball in 1921 (9) undertook a similar experiment with human beings. This experiment, conducted with more than six thousand school children in Akron, Ohio, where goiter appeared to be endemic, yielded remarkably encouraging results.

At the beginning of the test, 4,495 children who had no goiter were divided into two groups, one of which voluntarily received sodium iodide daily in a 0.2 gram dose distributed over a period of two weeks each spring and each fall. After two and one-half years it was found that only 5 out of 2,190 children who received extra iodine had developed goiter, while 495 out of 2,305 who had received no extra iodine developed goiter. Thus, in the one group of children initially free of goiter, only 0.2% developed the disease when treated with iodine, whereas more than 20% of the second group who had not received iodine, developed the disease under otherwise similar conditions. At the same time it was found that in another group of children already having goiter, more than 65% showed a reduction in the size of the goiter at the end of the iodine treatment period, while only about 13% of the untreated children exhibited spontaneous diminution.

Iodine Prophylaxis of Goiter

Although isolated instances had been reported previously, the investigation in Akron, Ohio represented the first large scale scientifically controlled human experiment. The results of this remarkable demonstration on the Ohio school children stimulated similar studies throughout the world, particularly in Switzerland, Austria and Germany. Iodine prophylaxis of goiter was soon adopted in many localities and resulted, in Switzerland for example, in a tremendous decline in the incidence of cretinism. Before the advent of iodine prophylaxis, it was not uncommon to find in Europe, whole villages and cantons populated by stunted, dwarfed cretins (10).

These experiences served to confirm the theories of early workers that a deficiency in the iodine supply of either food or drinking water was in some way responsible for the development of simple goiter. Geographical surveys throughout the world bolstered the evidence by revealing that the incidence of goiter is greatly increased in certain specific areas, notably the Himalayan Mountains of South Central Asia; the Alps, Pyrenees and Carpathian Mountain regions of Europe; the Andean Plateau and southeastern Brazil in South America; and the St. Lawrence and the Great Lakes basin extending through Minnesota, the Dakotas and adjacent Canadian provinces and the Pacific Northwest, in North America. Many of these regions are mountainous, others are far inland away from the sea, but all of them have in common an iodine-poor soil and water supply. In many of these areas government agencies have been set up to provide means whereby the inhabitants may be protected against the natural iodine deficiencies of the soil, crops and water supply. Among the measures instituted have been the enrichment of soils with iodine-containing fertilizers, the use of foods known to be rich in iodine, iodinization of the water supply, iodine medication, the general use of iodized salt, or the consumption of iodized milk.

The use of iodized salt has thus far been the most widely adopted and successful method because of its nearly universal use for seasoning and cooking, and the ease and economy of preparation. The use of milk with an increased iodine content has also been suggested, especially for children who ordinarily consume large quantities (11).

Iodine Prophylaxis in Animals: While goiter in farm animals is a common symptom of iodine deficiency, it actually signifies an advanced stage and the chief loss comes from interference with the reproductive processes and the birth of weak, deformed offspring which may fail to survive. Breeding difficulties among domestic animals long existed in varying degree throughout the goiter areas of the United States. It was soon found that these difficulties were associated with a nutritional deficiency of iodine and that supplementation of feeds with iodine salts solved this problem. It was also found that the exceedingly high death-rate of new born sheep due to goiter could be prevented by iodine treatment (12); that the so-called "hairless pig malady" responded to the same treatment (13)

and that various other abnormal conditions in sheep, swine, colts, calves, poultry and other livestock could be effectively eliminated by routine iodine prophylaxis (14, 15, 16). The ever-increasing use of iodine in the prevention of iodine deficiency diseases among domestic livestock has resulted in a tremendous economic saving. Adequate iodine nutrition of livestock has also increased the availability of iodine in the human dietary, especially with respect to the iodine content of milk.

The Iodine Content of Foods:

As has already been indicated, the iodine content of foods varies greatly and is dependent upon the iodine of the soil in the locality in which the food is grown. The iodine content of the soil in turn is generally dependent upon the nature of the mineral deposits from which it is formed. The richest mineral source of iodine is Chilean saltpeter, a common fertilizer. The iodine content of water usually reflects the iodine content of the soils and rock formations through which it has seeped. In general, vegetables and legumes are richer in iodine than cereals and fruits, while marine plants contain more iodine than land plants. Sea foods such as lobsters, oysters, and all kinds of fish are probably the richest source of iodine. Milk contains small amounts of iodine depending on the dairy feed, although certain milks produced in iodine-rich areas such as South Carolina, contain considerable quantities.

Milk from properly fed cows can be an important source of iodine in the diet. Orr and Leitch (16) report that feeding iodine supplements to dairy cows whose milk contains small amounts of iodine, considerably enhances the iodine content of the milk. They cite a typical example wherein the iodine content of cow's milk from a non-goitrous district was increased from a range of 4 to 7 micrograms per 100 cc. to more than 30 micrograms per 100 cc. by feeding small amounts of iodine.

Several years later a series of reports on the iodine content of milk were made by Remington and Supplee (17, 18) which revealed some very interesting data. Their studies were initiated in connection with investigations into the local availability of dietary iodine in South Carolina. Iodine deficiency had never been endemic in that region and it was determined that the crops raised in that area were quite high in iodine. In order to estimate accurately the total amount of iodine available to the local populace, it was necessary to include studies on the iodine content of milk produced in that area. Samples of mixed milk of several herds were collected at regular intervals throughout the state over a period of ten months and dried. The samples of dried milk were then analyzed for iodine content. The values obtained averaged approximately 572 parts of iodine per billion parts of dry milk (73 micrograms iodine per quart of liquid milk) as compared with values of about 265 and 322 parts of iodine per billion parts of dry milk (34 and 41 micrograms iodine per quart of liquid milk) from milk samples in relatively iodine-poor regions of other states. The high iodine con-

tent of the South Carolina milk represents the iodine content of the milk as obtained from cows receiving only locally grown foods and feeds and no iodine supplementation (17). Tests on the dried milk, as compared with the fluid whole milk, revealed that none of the iodine content is lost as a result of the dehydration process, and that prolonged storage of dry milk powder does not result in any detectable loss of iodine (18).

In a continuation of these studies, Hanford, Supplee and Wilson (19) reported the effect of feeding iodized dry milk to dairy cows on the iodine content of their freshly secreted milk. They found that by this means the iodine content of cows' milk can be appreciably enhanced. A further observation was the fact that the iodine level of the milk is increased only up to a certain physiologic level, beyond which it cannot be raised even by greater iodine supplementation of the feed. The iodine content of cows' milk, therefore, can not be increased naturally beyond physiologically safe levels.

*Iodine Content of Some Foods**

FOODS	SOURCE	PARTS IODINE PER BILLION
SEAFOODS		
Cod, salt	Pacific	660
Crabmeat (canned)	Oregon	148
	Virginia	420
Herring, smoked	.....	530
Oysters	Pacific	935
Salmon, chinook (canned)	Alaska	670
Shad roe	Washington	1,132
FRUITS AND VEGETABLES		
Asparagus	Pennsylvania	108
Banana	America	200
Broccoli (cooked)	Ohio	37
Cantaloupe	Ohio	23
Potatoes (boiled)	Ohio	34
Peaches (canned)	Ohio	161
String beans	Pennsylvania	20-33
MEATS		
Bacon	Ohio	162
Beef (roasted)	Ohio	92
Lamb chop	Ohio	146
BREAD AND CEREALS		
Bread, white	Ohio	132
Bread, whole wheat	Ohio	108
Oats, rolled (cooked)	Ohio	157
DAIRY PRODUCTS		
Butter	Ohio	147
Cheese, cottage	Ohio	61
Cream, light	Ohio	57
Cream, whipped	Ohio	72
Milk	Ohio	33
	Wisconsin	42
	New York	35
	South Carolina	75

***Bridges, M. Dietetics for the Clinician, Lee & Febiger, Phila. 1941**

PROPERTY OF THE
SEATTLE PUBLIC LIBRARY

Human Requirements for Iodine:

The human organism has a definite nutritional requirement for iodine. The dietary amount necessary to meet this requirement should be sufficient to meet the daily losses by excretion and to maintain an adequate body reserve for the manufacture of the thyroid hormone. Several methods have been used to determine iodine requirements. One of these is to calculate the iodine intake of people living in goiter-free regions on the assumption that such people are receiving sufficient iodine for physiological needs. Perhaps a more accurate method is the detailed study of iodine balance, i.e. the comparison between daily intake and output of iodine.

The Food and Nutrition Board of the National Research Council recommends (1942) a daily allowance of about 0.002 to 0.004 milligrams of iodine a day for each kilogram of body weight. This amounts to about 0.15 to 0.30 milligrams daily for the adult. There is considerable evidence that the iodine requirement is heightened during pregnancy and it is recommended that additional iodine be supplied during this period (20).

The regular use of iodized salt provides a simple method for meeting the dietary iodine requirement. It is interesting to note from the data cited previously, that milk, which provides a large portion of many dietary essentials, may also contribute significant amounts of iodine. A quart of milk from iodine-rich areas, such as South Carolina, may supply from one-half to one-fourth of the recommended daily allowance of iodine, while the same amount of milk from average areas less rich in iodine, such as New York or Wisconsin, may supply from ¼ to about 1/10 of the daily iodine requirement. Thus, although market milk throughout the United States varies considerably in iodine content, it is possible for one quart of average milk to supply from ⅕ to 1/10 of the daily need for iodine.

Conclusion:

From the time of the ancients the nutritional importance of iodine, or sources thereof, has been apparent to all those concerned with the health and well-being of the human race. It remained for modern science to explain the old empirical use of iodine-containing remedies and to clarify the role of iodine in the body economy of man and other animals. It is known now that iodine is a specific dietary essential, important for the proper functioning of the thyroid gland as well as for the general health of the body. The tragedies of simple iodine deficiency resulting in goiter and in mentally and physically stunted children need no longer be inevitable with modern knowledge of iodine prophylaxis.

The importance of obtaining the proper supply of iodine in the daily diet is expressed in the following excerpt from an excellent review on the subject by Curtis and Fertman (21):

"Under ever increasing demands of wartime effort and production each individual should have, to thrive and function at his best, among other important elements an adequate supply of iodine. For iodine, not only a nutritional necessity in the prevention of goiter, plays an important role in the general well-being of all mammals. The increased physical activity and emotional stress occurring in our struggle for survival put greatly increased demands on the human body. Thus the optimal activity essential for any all inclusive war effort cannot be maintained without a sufficient supply of iodine."

REFERENCES CITED

1. COURTOIS, M. B. Découverte d'une substance nouvelle dans le Vareck. Ann. de Chem. *88*, 304 (1813).

2. CHATIN, A. Un fait dans la question du goître et du crétinisme. Compt. rend. Acad. d. sc. *36*, 652 (1853).

3. BAUMANN, E. Über das normale Vorkommen von Jod im Thierkörper. Ztschr. f. physiol. Chem. *21*, 319 (1895).

4. KENDALL, E. C. The isolation in crystalline form of the compound containing iodine, which occurs in the thyroid; its chemical nature and physiologic activity. J. Am. Med. Assn. *64*, 2042 (1915).

5. PERLMAN, I., I. L. CHAIKOFF, and M. E. MORTON. Radioactive iodine as an indicator of the metabolism of iodine. *I*. The turnover of iodine in the tissues of the normal animal with particular reference to the thyroid. J. Biol. Chem. *139*, 433 (1941).

6. BING, F. C. Iodine, in *Mineral Metabolism* by A. T. Shohl. Rheinhold Publishing Corp., N. Y., 1939.

7. MARINE, D. and C. H. LENHART. Further observations of the relation of iodine to the structure of the thyroid gland in the sheep, dog, hog and ox. Arch. Int. Med. *3*, 66 (1909).

8. MARINE, D. and C. H. LENHART. Observations and experiments on the so-called thyroid carcinoma of brook trout and its relation to ordinary goiter. J. Expt. Med. *12*, 311 (1910).

9. MARINE, D. and O. P. KIMBALL. Prevention of goiter in man. J. Am. Med. Assn. *77*, 1068 (1921).

10. MCCLENDON, J. F. *Iodine and the Incidence of Goiter*. University of Minnesota Press, 1939.

11. MEYER, J. H. The iodine content of milk; thesis for M. S. Dept. Surg. Res., Ohio State Univ., 1940.

12. MARINE, D. On the occurrence and physiological nature of glandular hyperplasia of the thyroid (dog and sheep) together with remarks on important clinical (human) problems. Bull. Johns Hopkins Hosp. *18*, 359 (1907).

13. HART, E. B. and H. STEENBOCK. Thyroid hyperplasia and the relation of iodine to the hairless pig malady. J. Biol. Chem. *33*, 313 (1918).

14. SMITH, G. E. Iodine requirement in the pregnant sow (fetal athyrosis). J. Biol. Chem. *29*, 215 (1917).

15. KALKUS, J. W. A study of goiter and associated conditions in domestic animals. Bull. 156, Washington State Expt. Sta. (1920).

16. ORR, J. B. and I. LEITCH. Iodine in nutrition; a review of existing information. Med. Res. Council, Spec. Rpt. Ser. 123 (1929).

17. REMINGTON, R. E. and G. C. SUPPLEE. Studies on the iodine content of milk. *II*. Variations in the mixed milk of herds. J. Dairy Sci. *17*, 19 (1934).

18. HANFORD, Z. M., G. C. SUPPLEE and R. E. REMINGTON. Studies on the iodine content of milk. *I*. Effect of dessication and storage. J. Dairy Sci. *17*, 15 (1934).

19. HANFORD, Z. M., G. C. SUPPLEE and L. T. WILSON. The iodine content of milk as affected by feeding iodized dry milk. J. Dairy Sci. *17*, 771 (1934).

20. MARINE, D. and O. P. KIMBALL. Prevention of goiter in man. J. Am. Med. Assoc. *77*, 1068 (1921).

21. CURTIS, G. M. and M. B. FERTMAN. Iodine in nutrition. J. Am. Med. Assoc. *121*, 423 (1943).

SEP 17 19

NEWS DIGEST

A NEW POTATO variety named Mohawk is to be made available to the public under the auspices of the U. S. Department of Agriculture. The Mohawk is described as long and smooth, without deep eyes, and excellent for baking. The new potato is a cross between two already highly valued varieties. It was originated in Maine eight years ago and has since undergone numerous test growings and perfections. Seed stock for professional growers will be ready next spring and consumers should find the Mohawk potatoes in the market when the new potato crop comes in.

—901

BIOTIN assays on various meat products have recently been reported and represent some of the earliest available data on the occurrence of this vitamin in foods. Of the meats tested, kidney and liver were found to be the richest sources of biotin. Heart, pancreas, and dark and light chicken meat were good sources. The so-called variety meats—beef-spleen, lung, brain and tongue—were found to contain about the same amount of biotin as do the muscle meats of beef, pork, lamb and veal. After cooking, the amount of biotin retained was found to average 77% in the meat alone or about 80% in the cooked meat plus drippings.

—902

DEHYDRATED CREAM SOUPS are meeting with considerable approval by the armed forces. Three varieties are now in use, namely, cream of pea, cream of onion and cream of tomato. Following the war these three dehydrated cream soups as well as five additional ones—carrot, spinach, corn, celery and asparagus—will be made available for civilian consumption. All eight varieties have a powdered milk base which adds to the nutritive value of the product. A six-ounce package stirred into boiling water makes a quart and a half of ready-to-eat soup.

—903

ICE CREAM has received official government recognition as an essential dairy food of high nutritive value. In recent literature on industrial nutrition released by the Food Distribution Administration, ice cream is listed as an important member of Group IV, comprising milk, cheese and other dairy products. Ice cream and the other dairy products in this group constitute one of the seven basic groups of foods listed by government nutrition experts as vital to good health. One or more foods from each of these basic groups should form part of the daily diet for good nutrition.

—904

THE AVAILABILITY OF VITAMIN C in raw cabbage and in home canned tomato juice has recently been determined by a series of tests on four young, healthy persons. The utilization of the vitamin C of each test food was compared with that of pure vitamin C tablets. The subjects were fed a basal diet neutral in reaction, to offset any acid-base influence on the vitamin, and were saturated with the vitamin before each test period. From the results of blood and urine analyses, it was apparent that the vitamin C of both raw cabbage and canned tomato juice are just as thoroughly utilized as is pure vitamin C itself. About 4 oz. of the cabbage or 7/8 cup of tomato juice was found to provide 50 milligrams of vitamin C, or about 2/3 of the recommended daily allowance for this vitamin.

—905

NUTRITIONAL THERAPY applied to a selected group of one hundred persons debilitated by dietary inadequacies to the point where they could no longer work, has resulted—in every instance—in complete rehabilitation of these individuals. One subject treated was so incapacitated as to be unable to walk or stand alone, others were suffering from acute nervous and mental derangements; none of them was sufficiently well to hold a job. Persistent therapy, including a well-balanced diet plus vitamin supplements gradually restored these people to the point where they could again secure and maintain jobs and earn sufficient funds to provide an adequate diet. This dramatic restoration emphasizes more strongly than ever the serious incapacitating effects of malnutrition and the tremendous loss to war industry engendered by poor eating habits. More than ever the basic seven classes of foods, I. green and yellow vegetables, II, oranges, tomatoes, grapefruit, III. potatoes and other vegetables and fruits, IV. milk and milk products, V. meat, poultry, fish or eggs, VI. bread, flour and cereals, VII. butter and fortified margarine, assume vital significance not only in the current war effort, but in the maintenance of normal, healthy lives.

—906

For further information or additional copies address:
RUTH WOODS, *Editor, Borden's Review of Nutrition* Research, 350 Madison Avenue, New York 17, N. Y.